The Interpretation of Functional Training and Its Application in Badminton

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Abstract - This paper summarizes the interpretation, characteristics and development of functional training in China and discusses its application in badminton by using the methods of literature study, logical analysis and experimentation. American athletic trainer from Attack Athletics designs dozens of training methods such as rope-ladder, shuttle run, dumbbell etc. for Sichuan Chuanwei Badminton Club. Through 6 weeks functional training before and at China Badminton Club Super League, this analysis finds the application of functional training in badminton helps badminton players to improve the working ability of muscle and the efficiency of force transfer. It also enhances the performance stability to combine functional training with badminton technical training.

Index Terms - functional training, badminton, application

I. Introduction

Functional training has received increasingly attention world widely. Until 1990, Chinese sport teams started to value physical training. Unfortunately some of them made mistakes in understanding it due to limited condition at that period of time. They trained one aspect but ignored key elements of physical stamina like speed, power and sensitivity. The State General Administration of Sport sends coaches and researchers to study abroad since 2006 which push us to realize that it is inevitable tendency in the sport science to control athletic training by researching on physical training [1].

II. The Interpretation, Characteristics and Development of Functional Training

A. The Interpretation of Functional Training

Functional training originated from the field of rehabilitation medicine. The therapist trains patients through imitating practice at *home* or work to help them get back to normal life as soon as possible. Now, functional training gradually penetrates into competitive sports from the gym and rehabilitation centre.

Gray (1997) is the first person to interpret the concept of functional training. He points out it is important to lay emphasis on the kinetic chain of the body instead of training the certain link; he suggests targeted training by analyzing different body movements and finding the weaknesses[2]. Physical training is designed to improve the functional movement patterns and functional athletic ability, to lay a solid foundation for the development of functional technology [3]. When the athletes are not good at basic operation range, balance and body control and r stability, the arrangement of training should be based on functional movement, supplemented by functional capacity; when they improve their flexibility and stability, we should increase the proportion of functional competitive ability training, and arrange training of functional movement patterns as appropriate to ensure the flexibility and stability. To summary opinions from professional institutions and scholars, in competitive sports functional training refers to the training of specific exercises consistent with human needs, in order to improve the sports action efficiency.

B. The Characteristics of Functional Training

There are 5 most notable features in functional training: consistency of practice methods and object motion; emphasizing on holistic movement, the role of body core, the proprioception and neural control; multi-planar motion. Gray uses a table to clearly show the differences between functional training and non-functional training. (Table I)

TABLE I Differences between Functional Training and Non-functional Training

Non-functional Training	Functional Training
Isolated action	Integration of isolated actions
Inflexible	Flexible
Does not meet the physical characteristics	Meet the physical characteristics
Does not exist in real-life sports	Exist in real-life sports
Non-chain movement	Chain movement
Resistant to gravity	Better use of gravity
Exists only in laboratory	Exists in daily life
Does not meet the biomechanical characteristics	Meet the biomechanical characteristics
Human Adaptation	Regulation relies on proprioception
In a one-dimensional planar movement	In a multi-planar movement

C. The Development of Functional Training

Along with the social development and scientific and technological progress, coach division is increasingly fine; the scientific physical training concept enjoys popularity domestically. Sports teams at all levels have increased emphasis on physical training, part of the national teams, professional teams started to set up "athletic trainer", some of

which with sufficient funds employ foreign athletic trainers, such as the national men's basketball team, the national tennis team and national badminton team. In this way, functional training was gradually introduced in the domestic sports training. In early 2010, Beijing Institute of Sports Science has established the first "functional training laboratory" which attracts hockey, synchronized swimming, diving, volleyball, gymnastics, taekwondo, and many items of professional sports teams and elite athletes to the laboratory to do systematic physical training [4].

III. The Application of Functional Training in Badminton

Functional training always considers the body a complete system; it emphasizes the linkages between the different segments of the movement and interaction. China paid much attention on strength training or basal metabolic training in badminton in the past, which leads a large gap with real athletic abilities in the competition. Due to the limited awareness and conditions in the past, our training methods resulted in injury-plagued; compared with foreign athletes, the sporting life of our athletes are relatively short. Functional training plays important role in transforming and connecting basic physical training and competition needs. Discussion in this regards promoting players' competitive ability and the efficiency of transformation of basic training to the tournament.

A. The Application Time

According to the theory of the expert from Attack Athletics (AA), practices and games are supposed to be held on the peak. At the late period of winter training, the fundamental forces and stability of the athletes increase, laid the Foundation for the next phase of functional training; at the period before games, we need to reduce the amount of training, enhance the training intensity, and move closer to the specific actions.

B. The Implementation of Functional Training

This article tries to discuss the application in badminton by following 6 weeks functional training designed by AA expert for Sichuan Chuanwei badminton club in and before 2012 China Badminton Super League. Specific characteristics of badminton determine the energy metabolism of athletes is a mixed process of anaerobic and aerobic metabolism. According to studies, anaerobic metabolism takes 30%-40% while aerobic metabolism takes 60%-70% (in the period of interval) in badminton. The scoring system shortens the time of each badminton game though the significantly increased intensity requires higher demands on players ' specific fitness. Among 5 players of Single group in Sichuan Chuanwei Club, 3 of which have ankle injuries, one has Achilles tendon injury and one has knee injury; one play of Double group has old knee injury. The AA expert tests and suggests Sichuan team is mostly in need of enhancing strength and the ability to move quickly in this phase. Three concepts are suggested by AA expert:

a. location of the punches should be the torso, focus on the torso; **b.** the movement of feet is the groundwork, master the correct way of moving or irregular actions will bring injuries; **c.** the rest is part of the training, to train on the peak, shorten time, increase the intensity, learn to rest actively.

Human body is supported by bones, connected by joints between the bones in order to form a chain-like structure. All complex techniques in sports are achieved by the kinematic chain. Various organ systems of the body are intimately linked and mutually influenced. Stimulation of exercises stress on the body and adaptive changes of organ system are interrelated and mutually restricted. From the sources to start up, specific needs requires strength passes from ankle-knee-badminton-core area-fingers-wrist- badminton, reflects the General system performance. It is very difficult to maintain the smooth power delivery if there is any link problems in the kinematic chain. Strength training in the past mainly uses the squat, bench press, pull, pull down, lift and sit-ups, all movements of which are completed in a single plane. Badminton is a dynamic equilibrium process which involves loss of balance in the air to restore balance after landing. Badminton players need body coordination and punch in the three dimensional plane. Balance is usually considered a static process, and in fact is a comprehensive, dynamic, three-dimensional process contains multiple neural pathways. It needs all the sensory feedback. Thus the AA expert designs a functional training to develop the stability, strength, speed, power and neuromuscular efficiency, improve kinesthetic and reduce injuries (Table Ⅱ).

In this plan, 1-4 are sensitivity training, 5-8 are speed endurance enhancement, 9-21 are for strength training, mainly to overcome their own weight, strengthen the torso. They are badminton special protections in the highest rate of injuries of ankle, knee joints, shoulder joints, and so on. It schedules 3 times a week, 60-90 minutes at a time, and reduces training during a match. Meanwhile integrate into functional training with badminton specific technology: for example, Speed training is combined with multi-ball training of badminton, midfield rapid assault on either side, midfield driving ball quickly on both sides, fast block at the net, midfield stroke and followed up, strike defense quickly getting rid of; Quartet ran after endurance training, midfield stroke on both sides, smash, follow up, block, and passive save; Multi-ball training after power training, two bottom line smashing, sideways surprise assaults, assaults after midfield active screen exercises.

The combination of functional training and badminton specific technical training, clear understanding the need and reasonableness of multi-ball training, setting quantitative standards for the success rate, quality and quantity in training help the effect of functional training translated into specific technologies and the performance of competition.

TABLE Ⅱ Methods of Functional Training

	Exercises	Load	Groups	Requirements	Intervals/s
1	Rope ladder（8steps）	Body weight	2	Semi-acceleration	60
2	Polygon jump	Body weight	3	Trunk control	90
3	Chasing tennis	Body weight	2	Circling faster	90
4	Start-up and brake	Body weight	2	Remain flexible	60
5	4 meters shuttle run	Full load	2	In situ of trunk rotation	90
6	Mincing back hip rotation	Body weight	4	90° *2; 180° *2	30
7	Zigzag shuttle run	Body weight	2	2mins for one group	60
8	Caterpillar walking	Body weight	3	Knees cannot bend	90
9	Half-squats with elastic belt	Elastic belt	2	Stay low to the ground	30
10	Throwing medicine ball	4kg	6	Exerting force with knee	90
11	Arm-bent and wrist-bent with dumbbell	10-15lb	2	One group left, another right	60
12	Bow step with dumbbell	10-15lb	2	Don't lock the knee joint	120
13	Barbell squat	30kg	2	4*2	30
14	Grasp the barbell	30-50kg	2	10*1，4*2	30
15	Stand on tiptoe on steps	Body weight	2	20*1	120
16	Hanging exercises	Body weight	2	10*1	120
17	Back flexion at both ends	Body weight	3	10*1	60
18	Supine bridge maintaining	Body weight	2	2*2	10
19	Supine touched around ankle	Body weight	2	12*1	30
20	Push-ups	Body weight	2	One on flat，another feet up	30
21	Jump stool	Body weight	1	5*3	60

C. The Training Effect and Prospect

Athletes have increasing interests on the functional training which is different from the traditional physical training. The high-intensity training results a strong body reaction of the athletes. There is a decline in body fat content. The players reduce an average of 0.21 seconds in Polygon jumping in 4 weeks and the injuries are under control. Functional training rapidly improves the neuromuscular excitement and eases tension during 2012 China Badminton Super League. Due to multi-factors includes young players lacking experience, no stars players, problems in team and club management, Sichuan Chuanwei Club did not make breakthrough, but young athletes also emerges out to fight against top players like Lindan and Fu Haifeng to show where hope is.

Complete functional training includes three levels which are interlinked and progressive, constitute a "pyramid" model (Fig 1). The basis of the functional training is to acquire accurate action mode, it proceeds to ask the body functions most projects need, and finally the specific ability. It is a long systematic process, so does the combination and transformation of specific technology training and functional training. We should persevere instead of being confused by immediate setback or interest.

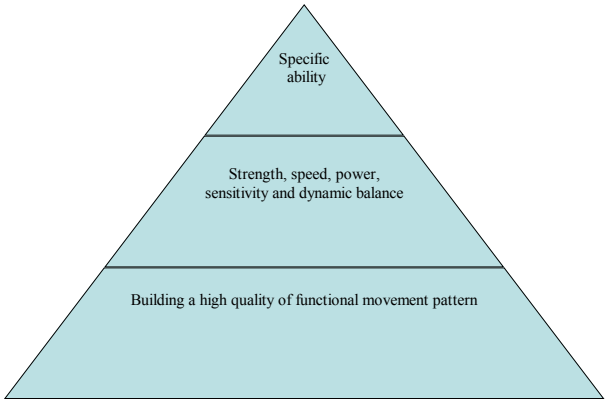

Fig. 1 Pyramid Model of Functional Training.

IV. Conclusion

Functional training refers to the training of specific exercises consistent with human needs, in order to improve the sports action efficiency. It integrates variety of sports research method in physical training, and improves the control of physical training through enhanced practice to ultimately enhance the fitness of players. NSCA positions itself as "bridges between sports and science", which is also pursued by Chinese sports science research - "the combination of scientific research and training".

To improve kinesthetic and reduce injuries is key to extend the sport life. Functional training could do it well by developing athletes' stability, strength, speed, power and neuromuscular efficiency. Compared with traditional physical training, functional training is better targeted and more effective for improving athletes' overall abilities and power

transmission efficiency. It does direct promotion in the realization of badminton skills.

Considering characteristics of energy metabolism in badminton, the combination of functional training and specific technical training and the upgrading of the means of multi-ball training can increase the technical stability and enhance the competitive ability of badminton players. Functional training in China has just started up, coupled with this is a long-term, systematic process. I believe that with the development of functional training, it will play a greater role in the training of competitive sports in China.

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